

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2016/2017

TCP2451 – PROGRAMMING LANGUAGE TRANSLATION
TCS 3311 – COMPILER DESIGN/
(All Sections / Groups)

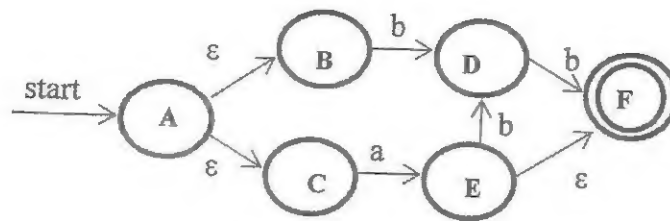
29 MAY 2017
9 a.m – 11 a.m
(2 hours)

INSTRUCTION TO STUDENT

1. Answer **ALL** questions.
2. This question paper has 4 printed pages excluding the front cover.
3. Please print all your answers in the answer booklet provided.

QUESTION 1

Given the following NFA:



- (a) Write down a regular expression that is recognized by this NFA. [6 mark]
- (b) What is the purpose of ϵ -closure and explain ϵ -closure of a state using an example from this NFA. [7 marks]
- (c) Convert the NFA to a DFA using subset construction method. Show the transition table and the DFA with all your workings. [12 marks]

Continued

QUESTION 2

Given the following Java CUP specification file:

```
package myparser;

import java_cup.runtime.*;

/* REMOVED */

/* Precedences */
precedence left PLUS;
precedence left TIMES;

/* The grammar */
program ::= header body;

header ::= COMPANY COLON CEO;

body ::= BRACKET statement BRACKET;

statement ::= IDENTIFIER ASSIGN expr SEMICOLON;

expr      ::= expr PLUS NUMBER
           | expr TIMES NUMBER
           | NUMBER
           ;
```

- (a) Complete the “REMOVED” commented section of this file so that it can be used to generate a parser. [8 marks]
- (b) Give an example of a source program that conforms to this syntax. You may specify any assumptions on the symbols used. [6 marks]
- (c) Modify the grammar above so that the program body can contain one or more statements. Explain with an example how the changes can allow more statements. [11 marks]

Continued

QUESTION 3

- (a) One type of static checking is uniqueness checks. Elaborate what is a uniqueness check. Provide an example.

[5 marks]

- (b) Draw the DFA to be used to build an LR(0) parser for the following grammar.

$$E \rightarrow T + T \mid T - T$$
$$T \rightarrow F * F \mid F / F$$
$$F \rightarrow \text{id}$$

[10 marks]

- (c) Use the DFA in Question 3(b) to create the parsing table for an LR(0) shift-reduce parser.

[10 marks]

Continued

QUESTION 4

(a) Implement the following expression as an indirect triples three-address code.

$a := b / -c - b * -c$

[5 marks]

(b) Compare and contrast between the following scope types:

- i. Scope of variables in statement blocks
- ii. Scope of global variables
- iii. Scope of external variables
- iv. Scope of formal arguments of functions
- v. Scope of labels

[10 marks]

(c) What are the design issues in in a code generator? Give 5 of them.

[10 marks]

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